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ABSTRACT

This brief paper describes several computing tools that have been effectively used by individuals with mobility impairments. Emphasis is on tasks to be completed and how the individual's abilities (not disabilities), with possible assistance from technology, can be used to accomplish them. Preliminary information addresses the importance of facility access, furniture (proper seating and flexibility in positioning of keyboards, computer screens, and table height). Suggestions for keyboard access include pointers, use of software settings and functions available in standard software packages, use of a keyguard, alternative keyboards, and virtual keyboards. Also discussed are word prediction programs, alternative pointing systems, switch keyboard and mouse access using scanning or Morse code, speech recognition programs, and reading systems. Uses of low tech tools (such as adhesive Velcro) are also noted. The paper also lists contact and other information resources associated with Project DO-IT at the University of Washington. (DB)

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Working Together: Computers and People with Mobility Impairments

University of Washington
DO-IT

2000

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Working Together: Computers and People With Mobility Impairments

An elevator or ramp provides access to spaces when a staircase is insurmountable for someone who uses a wheelchair. Similarly, specialized hardware and software, called assistive or adaptive technology, allows people with mobility impairments to use computers. These tools allow a person with limited, uncontrollable, or no hand or arm movement to successfully perform in school and job settings. Adaptive technology can allow a person with a mobility impairment to use all of the capabilities of a computer.

While some mobility impairments are obvious to the observer, others are less apparent. For example, individuals with repetitive stress injuries (RSI) may have no visible impairments yet require adaptive technology in order to use a computer without experiencing pain. However, people who use wheelchairs or crutches may require no special technology to access a computer. Although it may be helpful for adaptive technology practitioners to know details about specific disabilities such as Muscular Dystrophy, Cerebral Palsy, spinal cord injury, Multiple Sclerosis, or RSI, it is not essential to be an expert on these conditions. People with the same medical condition, such as Muscular Dystrophy, may require different adaptive technology. On the other hand, an accommodation for someone with Cerebral Palsy may also be used by someone with RSI. Also, learning, sensory, or other disabilities may co-exist with a mobility impairment and can create additional computer access challenges.

While it is helpful to recognize the specific limitations of an individual, it is more important to focus on the task to be completed and how his abilities, perhaps assisted with technology, can be used to accomplish the goal or task. Work closely with the person with a mobility impairment to first determine what he needs or desires to accomplish by using a computer. Specific accommodations can then be explored that provide access to software or to a specific device such as a keyboard or mouse.

The specific need for adaptive technology is unique to the individual. Trial and error may be required to find a set of appropriate tools and techniques. The person with a mobility impairment should play a key role in determining her goals and needs when selecting her adaptive technology. Once basic tools and strategies are initially selected, she can test drive, discard, adapt, and/or refine. The end user of the technology should ultimately determine what works best.

Following are descriptions of several computing tools that have been effectively used by individuals with mobility impairments. This list is not exhaustive and should not limit the person with a mobility impairment or the adaptive technology practitioner from trying other approaches.

Facility Access

Before a person can use a computer, she needs to get within effective proximity of the workstation. Aisles, doorways, and building entrances must be wheelchair accessible. Other resources such as telephones, restrooms, and reference areas should be accessible as well. Don't overlook a simple barrier such as a single step or narrow doorway. Work with architectural accessibility experts to ensure physical accessibility.

Furniture

Proper seating and positioning is important for anyone using a computer, perhaps even more so for a person with a mobility impairment. Specialized computer technology is of little value if a person cannot physically activate these devices due to inappropriate positioning. A person for whom this is an issue should consult a specialist in seating and positioning – often an occupational therapist – to ensure that correct posture and successful control of devices can be achieved and maintained.

Flexibility in the positioning of keyboards, computer screens, and table height is important. As is true for any large group, people with mobility impairments come in all shapes and sizes. It is important that keyboards can be positioned at a comfortable height and monitors can be positioned for easy viewing. An adjustable table can be cranked higher or lower, either manually or with a power unit, to put the monitor at a proper height. Adjustable trays can move keyboards up and down and tilt them for maximum typing efficiency. Be sure to consider simple solutions to furniture access. For example, wood blocks can raise the height of a table and a cardboard box can be used to raise the height of a keyboard on a table.

Keyboard Access

The keyboard can be the biggest obstacle to computing for a person with a mobility impairment. Fortunately, those who lack the dexterity or range of motion necessary to operate a standard keyboard have a wide range of options from which to choose. Pointers can be held in the mouth or mounted to a hat or headgear and used to press keys on a standard keyboard. Repositioning the keyboard to the floor can allow someone to use his feet instead of his hands for typing.

Before purchasing a complex keyboard option, evaluate the accessibility features that are built-in to current popular operating systems. For instance, the Accessibility Options control panel in current versions of Microsoft Windows™ contains a variety of settings that can make a standard keyboard easier to use. For a person who has a single point of entry (a single finger or mouth-stick), use of StickyKeys allows keystrokes that are usually entered simultaneously, such as Ctrl-key shortcuts found in menus, to be entered sequentially. FilterKeys can eliminate repeated keystrokes for a person who tends to keep a key pressed down too long. Check the Settings for these features and experiment with different time delays for optimum effect. The Macintosh operating systems have similar features in the Easy Access control panel.

Consider using the features common in popular word processors, such as Microsoft Word™, to ease text entry. The AutoCorrect™ feature of Word allows sentences or blocks of text, such as an address, to be represented by unique and brief letter sequences. For example, entering "myaddr" could be set to automatically display one's address in proper format. Long words can be abbreviated and entered into the AutoCorrect settings to increase typing speed and accuracy.

A keyguard is a plastic or metal shield that fits over a standard keyboard. Holes are drilled into the guard to help an individual with poor dexterity or hand control press only the desired key without inadvertently pressing other keys. Keyguards are available from a variety of manufacturers (e.g., Don Johnston, TechAble).

Alternative keyboards can be considered for a person who cannot effectively operate a

regular keyboard despite changing settings or using a keyguard. For people who have limited range of motion, a mini-keyboard (Tash) may be considered. If a person has good range of motion and poor dexterity, a keyboard with extra-large keys (e.g., IntelliTools) can offer a good solution. Several vendors offer an array of alternative keyboards, including those that are configured to relieve the effects of RSI (e.g., Infogrip).

When physically activating a keyboard – whether through changing the settings or switching to an alternative keyboard – is not possible, evaluate the utility of a virtual keyboard. A virtual keyboard appears on the computer screen as a picture of a keyboard. A mouse, trackball, or alternative pointing system activates the keys on the screen and inserts the appropriate keystrokes into the desired program. A person can enter text by clicking on specific keys on the keyboard image. Modifier keys such as **Ctrl** and **Alt** can also be accessed, as can the function keys. Some virtual keyboards incorporate word prediction (see below) to increase entry speed and may include alternate layouts in addition to the traditional "QWERTY" layout found on standard keyboards.

Word Prediction

Typing words correctly and quickly can be a challenge for some people with mobility impairments. Word prediction programs prompt the user with a list of likely word choices based upon words previously typed. Some word prediction software automatically collects new words as they are used, and consider a person's common vocabulary when predicting in the future. Word prediction is often used with a virtual keyboard to increase accuracy and typing speed. For those who type much faster than 13-15 words per minute, however, use of word prediction can actually decrease typing speed, because the user is required to look in two places – the keyboard and the screen.

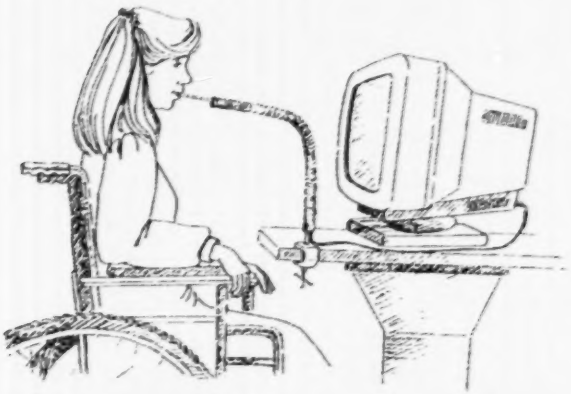
Alternative Pointing Systems

With the advent of graphically-oriented operating systems, it is vital to have access to a mouse or an alternative pointing device. For those who lack the coordination to use a standard mouse, there are many alternatives to consider. Trackballs are a good first choice; the control surface can be easier to manipulate and the buttons can be activated without affecting the pointer position. Some trackballs (e.g., Kensington) offer additional buttons that add functionality such as double-clicking, click and hold, and other commands, and can be programmed to a person's specific needs. A simple accommodation for use of a pointer by someone who can't use his hands but can move his feet is to place a standard mouse or trackball on the floor.

Other alternative pointers can be found in many mainstream computer stores and supply catalogs. External touchpads, similar to those built into many notebook computers, offer an ideal pointing system for some. Handheld pointing devices such as the ProPoint™ (Interlink Electronics) with a small control surface area may be useful for someone with very limited hand mobility. For people with mobility impairments who already use a joystick to drive a wheelchair, a device such as the Roller Joystick (Penny & Giles) may be an excellent choice.

A person with good head control who cannot control a mouse or alternative pointing device with any limb should consider using a head-controlled pointing system such as HeadMouse™ (Origin Instruments) or HeadMaster™ (Prentke Romich). These head-controlled pointing systems use infrared

detection and a transmitter or reflector that is worn on the user's head and translates head movements into mouse pointer movement on the computer screen. Use of an additional switch (see Switch Access below) replaces the mouse button. Combining a head pointing system with an on-screen keyboard allows full computer control to someone who cannot use a standard keyboard and mouse.



Switch Keyboard and Mouse Access Using Scanning or Morse Code

When a person's mobility impairment prevents the use of a standard keyboard or mouse, using a switch may be a possibility. Switches come in a nearly limitless array and can be controlled with nearly any body part. Switches can be activated with a kick, swipe of the hand, sip and puff by mouth, head movement, eyeblink, or touch. Even physical closeness can activate a proximity switch. These switches work in concert with a box or emulator that sends commands for the keyboard and/or mouse to the computer. While switch input may be slow, it allows for independent computer use for some people who could not otherwise access a computer.

There are a variety of input methods that rely on switches. Scanning and Morse code are two of the most popular. Upon activation of a switch, scanning will bring up a main menu of options on the screen. Additional switch activations allow a drilling down of menu items to the desired keystroke, mouse, or menu action. Morse code is a more direct method of control than scanning and with practice can be a very efficient input method. Most learners quickly adapt to using Morse code and can achieve high entry speeds.

Switch systems should be mounted with the assistance of a knowledgeable professional, such as an occupational therapist. If mounted to a wheelchair, it is important that switch mounting does not interfere with wheelchair controls. Seating and positioning specialists can also help determine optimum placement for switches, reduce the time in discovering the best switch system, and maximize positive outcomes.

Speech Recognition

Speech recognition products may provide an appropriate input tool for individuals with a wide range of disabilities. Speech recognition software converts words spoken into a microphone into machine-readable format. The user speaks into the microphone either with pauses between words (discrete speech) or in a normal talking manner (continuous speech). The discrete speech system, although slower, allows the user to identify errors as they occur. In continuous speech systems, corrections are made after the fact. Speech recognition technology requires that the user have moderately good reading comprehension in order to correct the program's text output. Voice and breath stamina should also be a consideration when evaluating speech recognition as an input option.

Reading Systems

An individual who has a difficult time holding printed material or turning pages may benefit from a reading system. These

systems are typically made up of hardware (scanner, computer, monitor, and sound card), Optical Character Recognition (OCR) software, and a reading/filing program. The system provides an alternative to reading printed text. Hard copy text is placed on the scanner where it is converted into a digital image. The image is then converted to a text file, making the characters recognizable by the computer. The computer can then read the words back using a speech synthesizer and simultaneously present the words on screen. Use of such a system may require assistance, since a disability that limits manipulation of a book may also preclude independent use of a scanner.

Low-Tech Tools

Not all assistive technology for people with mobility impairments is computer-based. The use of such common items as adhesive Velcro to mount switches or power controls can provide elegantly simple solutions to computer access barriers. Often, tools of one's own making provide the most effective and comfortable accommodations for mobility impairments.

Videotape

A ten-minute videotape, *Working Together: Computers and People with Mobility Impairments*, demonstrates key points summarized in this handout. It may be purchased by sending $25 to DO-IT. Contact DO-IT for a list of more than 20 other videotapes that may be of interest. Permission is granted to reproduce DO-IT videotapes for educational, non-commercial purposes as long as the source is acknowledged.

Resources

Useful information about products that can assist an individual with a mobility impairment can be found at the following Web sites.

- Don Johnston, Inc.: *http://www.donjohnston.com/*
- Infogrip: *http://www.infogrip.com/*
- IntelliTools: *http://www.intellitools.com/*
- Interlink Electronics: *http://www.interlinkelec.com/*
- Origin Instruments: *http://www.orin.com/*
- Penny & Giles: *http://www.pgcontrols.com/*
- Prentke Romich: *http://www.prentrom.com/*
- Kensington: *http://www.kensington.com/*
- TASH: *http://www.tashinc.com/*
- TechAble: *http://www.techable.com/*

Additional publications regarding the use of electronic and information on technology use by people with disabilities can be found at *http://www.washington.edu/doit/Brochures/Technology/*. Select *Disability-Related Resources on the Internet* for a comprehensive list of discussion lists and Web sites.

To locate technical assistance centers in your state or region, consult *http://www.resna.org/taproject/at/statecontacts.html* or *http://www.adata.org/dbtac.html*, respectively.

Grants and gifts funds DO-IT publications, videotapes, and programs to support the academic and career success of people with disabilities. Contribute today by sending a check to DO-IT, Box 355670, University of Washington, Seattle, WA 98195-5670.

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About DO-IT

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